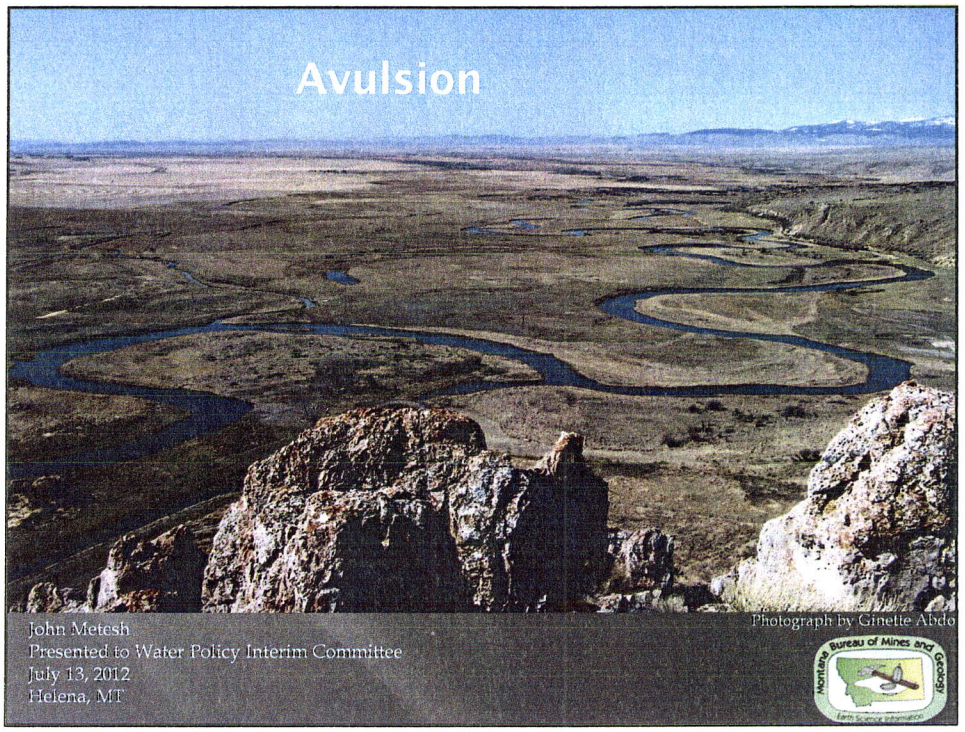
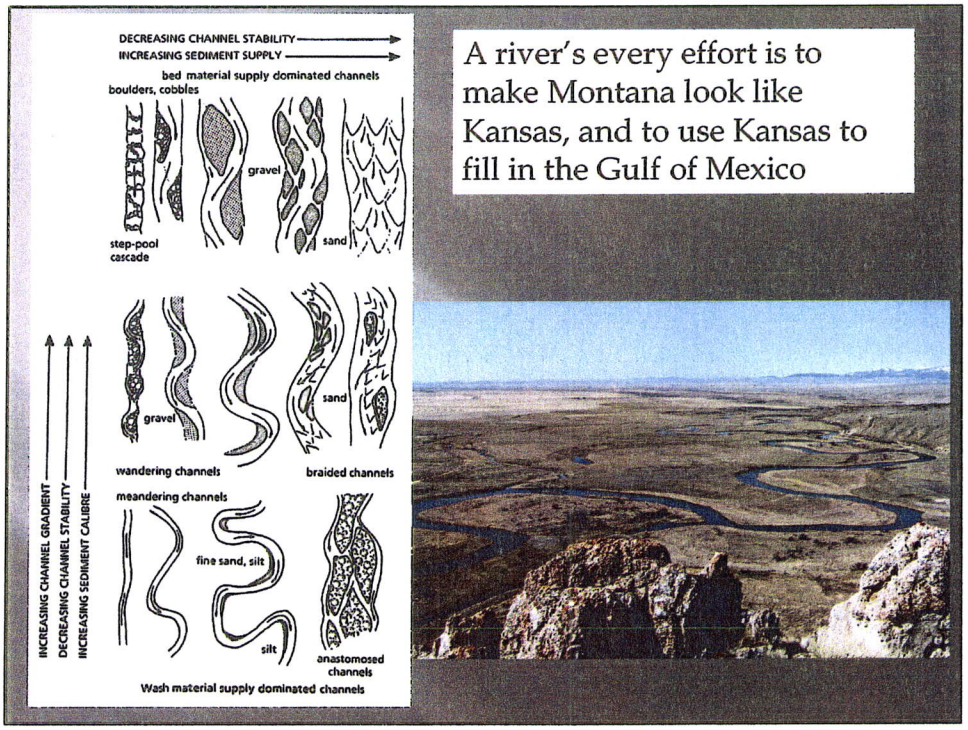

Avulsion
Photograph by Ginette Abdo
John Metesh
Presented to Water Policy Interim Committee
July 13, 2012
Helena, MT
Montana Bureau of Mines and Geology

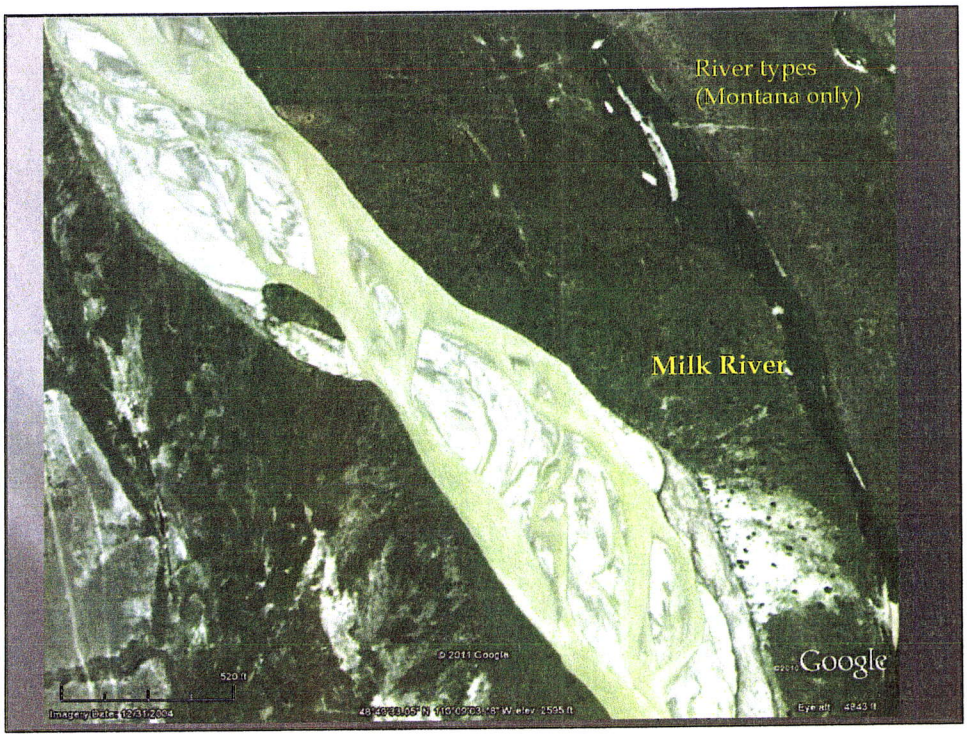

DECREASING CHANNEL STABILITY
INCREASING SEDIMENT SUPPLY
bed material supply dominated channels
boulders, cobbles
gravel
sand
step-pool cascade
gravel
sand
wandering channels
braided channels
meandering channels
fine sand, silt
silt
anastomosed channels
Wash material supply dominated channels
INCREASING CHANNEL GRADIENT
DECREASING CHANNEL STABILITY
INCREASING SEDIMENT CALIBRE
A river's every effort is to make Montana look like Kansas, and to use Kansas to fill in the Gulf of Mexico

Avulsion: the rapid abandonment of a river channel and the formation of a new river channel. Avulsions occur as a result of channel slopes that are much lower than the slope that the river could travel if it took a new course.

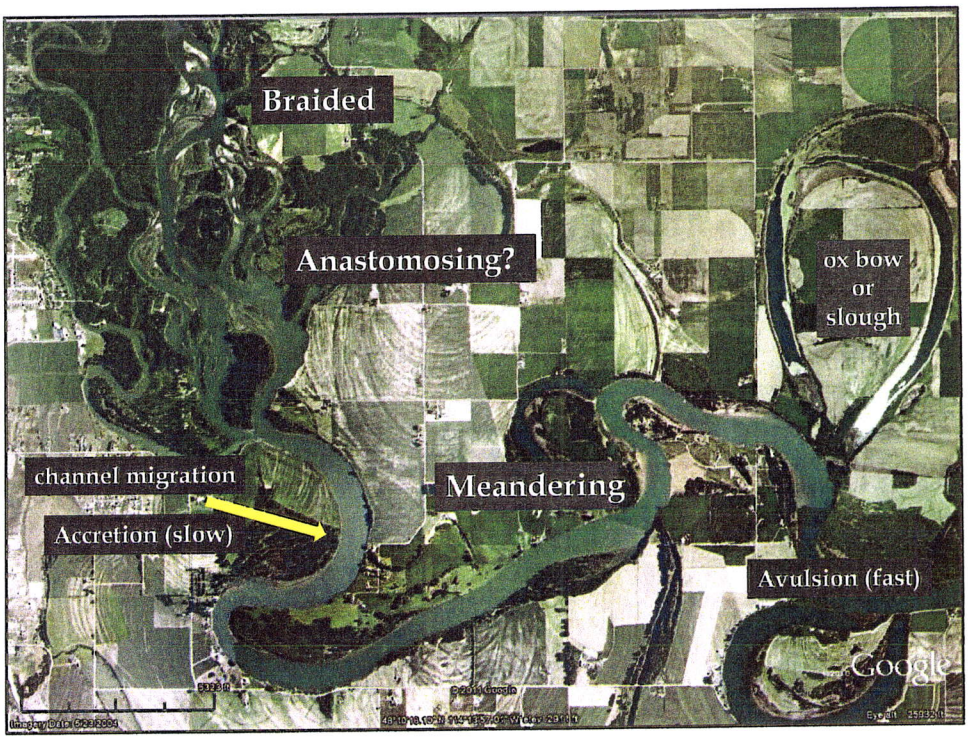
Rivers can also avulse due to the erosion of a new channel that creates a straighter path through the landscape.

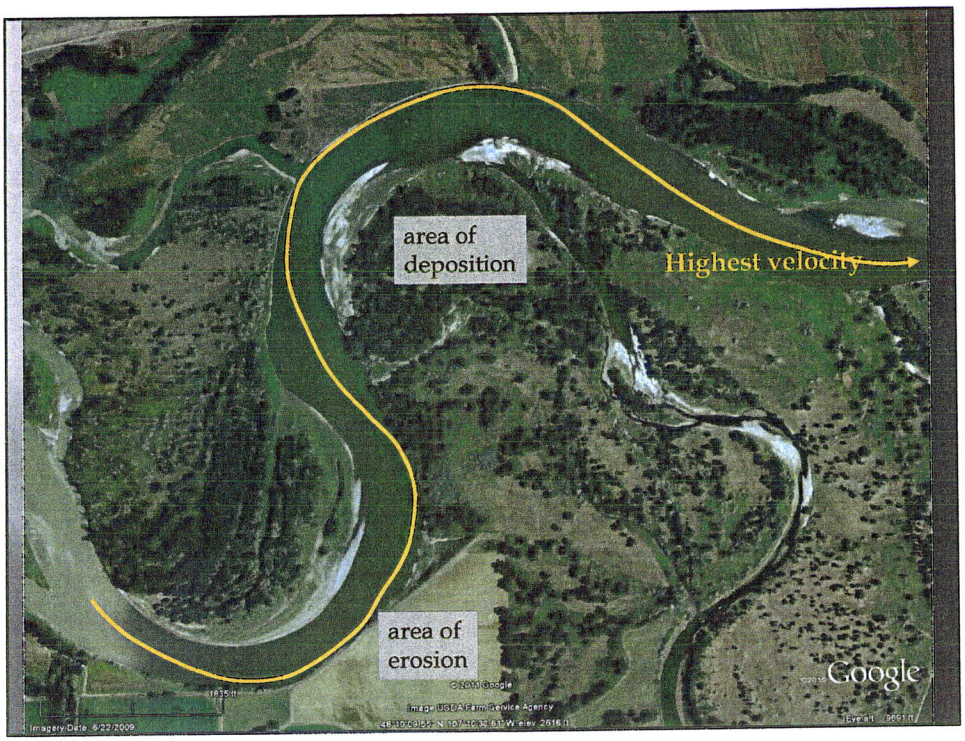
Accretion: The gradual deposition of sediment along the edges of a channel by lateral migration. One of the bar formation processes that creates bars opposite of the meander bend.

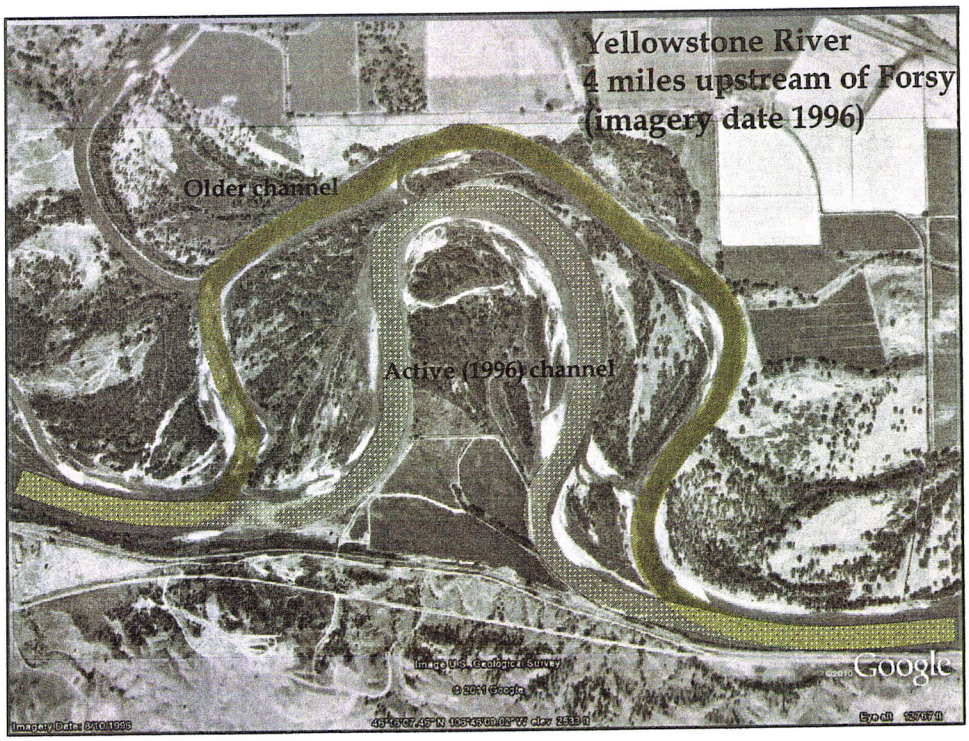
Accretion occurs when a stream gradually and imperceptibly changes its course over a period of time, resulting in sedimentary deposits on one bank along the water line

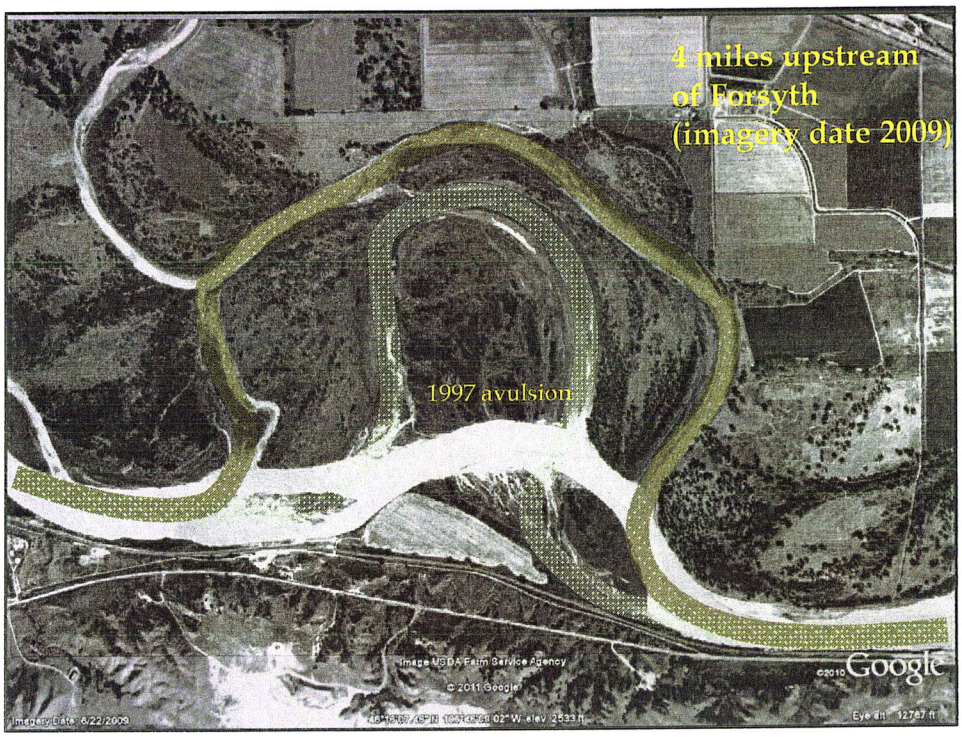



Beaverhead River
below Dillon
© 2011 Google
Google
1102 ft
Imagery Date: 12/31/2004


Braided
Anastomosing?
ox bow
or
slough
channel migration
Accretion (slow)
Meandering
Avulsion (fast)
Google


area of deposition
Highest velocity
area of erosion
Google


Yellowstone River
4 miles upstream of Forsy
(imagery date 1996)
Older channel
Active (1996) channel
Google



Predicting Channel Migration - the mapping approach:

Historic air photo (especially Soil Conservation Service photos, LANDSAT)

Historic ground photos (MDOT, USFS, news)

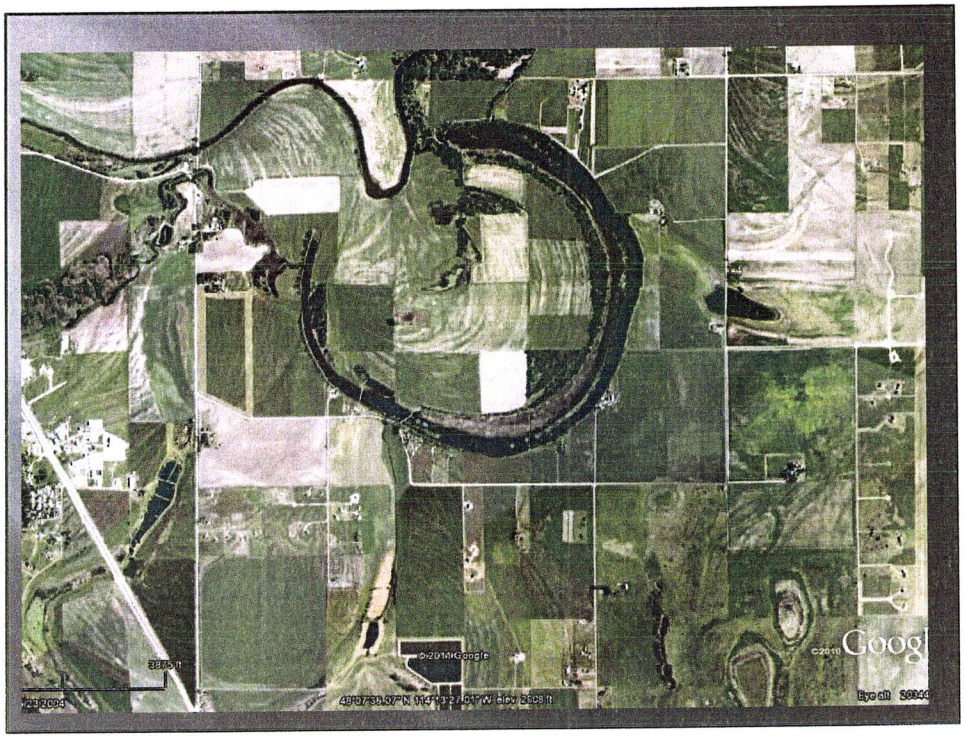
Historic records/ news (events)

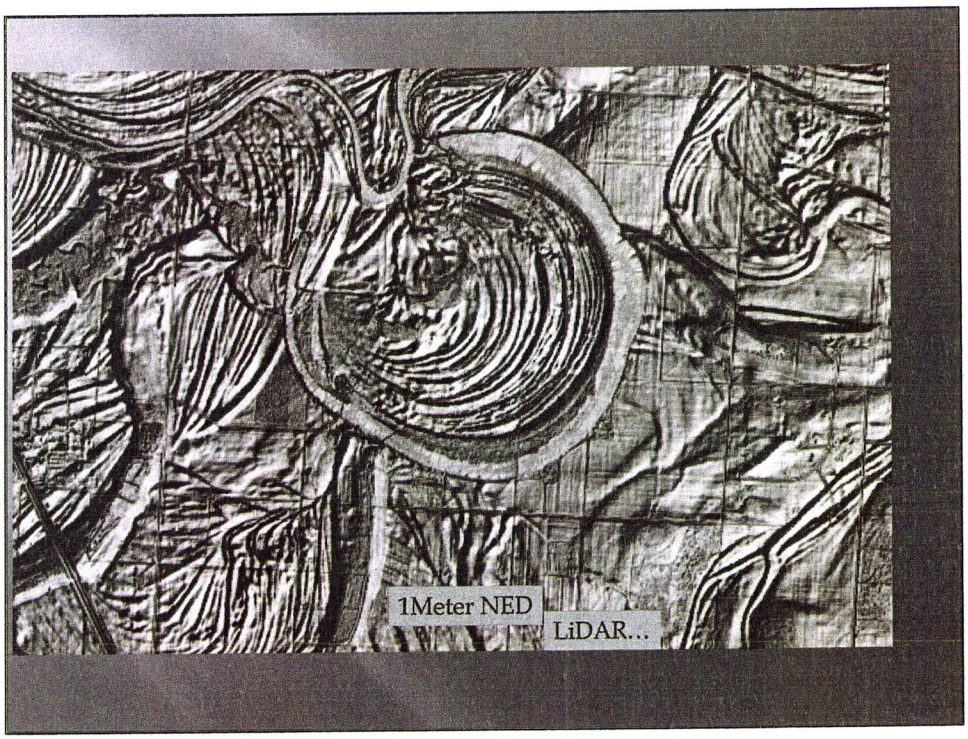
Elevation Analyses:

- Ground survey / GPS
- DEMs (30 meter)
- NED (1 meter)
- Light Detection and Ranging (LiDAR) (sub meter)

Coupled with stream discharge and flood history, frequency analyses


Older channel
30 Meter DEM




1Meter NED
LiDAR…

Historical Migration Zone (HMZ)
The collective area the channel occupied in the known historical record.

Avulsion Hazard Zone (AHZ)
The area not included in the HMZ that is at risk of avulsion over the timeline of the CMZ. **Avulsion** is the process in which a stream rapidly abandons a developed channel and creates a new one. Channels may avulse into an abandoned channel (second-order avulsion) or create a new channel (first-order avulsion) depending on the preexisting boundary conditions that initiate the avulsion. Conversely, **accretion** is the gradual deposition of sediment along the edges of a channel by lateral migration. One of the bar formation processes that creates bars opposite of the meander bend.

Erosion Hazard Area (EHA)
The area not included in the HMZ or the AHZ that is at risk of bank erosion from stream flow or mass wasting over the timeline of the Channel Migration Zone (defined below). The EHA comprises 1) the Erosion Setback Zone (ESZ) which is the area at risk of future bank erosion by stream flow and 2) the Geotechnical Setback Zone (GSZ) which the channel and terrace banks that are at risk of mass wasting.

Disconnected migration zone (DMA)
The area located in CMZ where man-made structures restrict channel migration.

Channel Migration Zone (CMZ) is the area comprised of HMZ+AHZ+EHA-DMA.
That is, CMZ is the sum of its components. Note : the DMA is not always excluded in some determinations.